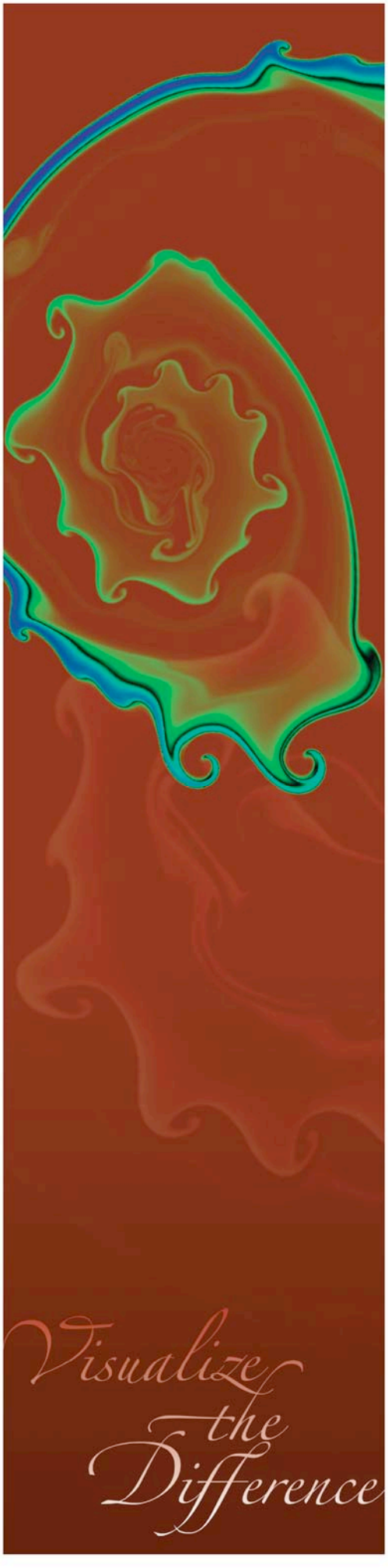
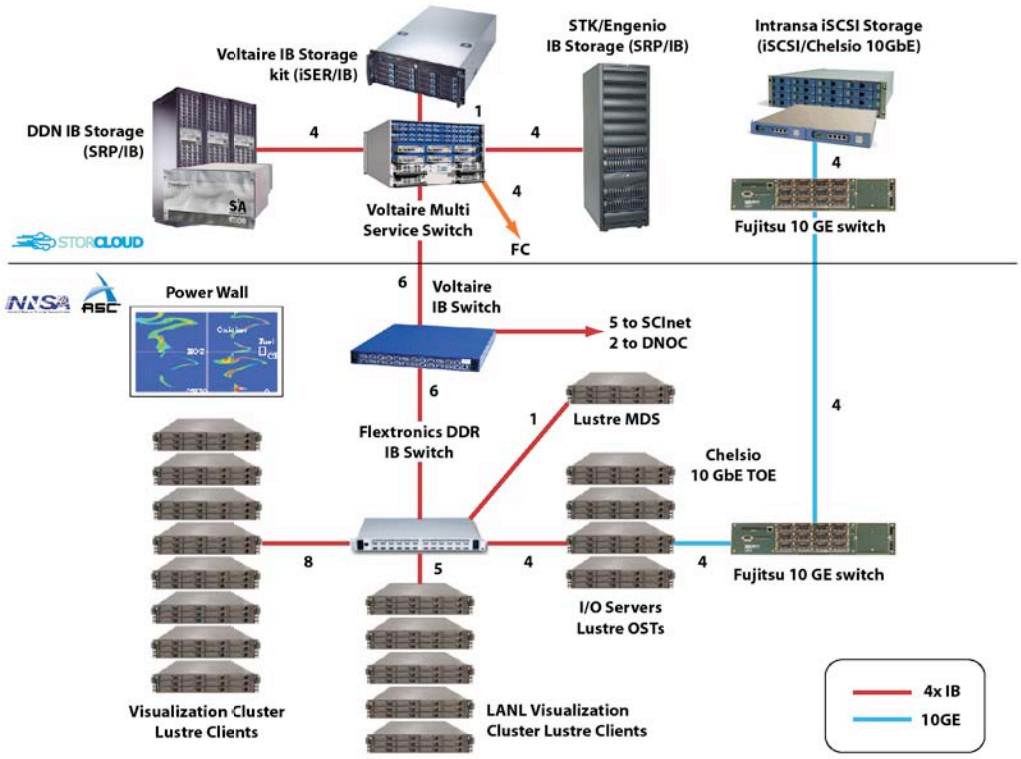


The StorCloud Demonstration

Knowledge Discovery from Terascale Dataset



The Tri-Lab infrastructure team- SNL: Helen Chen, Jeffrey Decker, and Frank Bielecki, LLNL: Holger Jones, LANL: Parks Fields

The knowledge and understanding represented in terascale datasets from scientific simulation are the goal of the NNSA/ASC program. Commodity clusters provide a convenient and cost-effective platform to visualize these datasets. StorCloud is a new initiative sponsored by the Supercomputing Conference to showcase emerging storage and networking technologies to meet the extreme demand in storing and handling of terascale datasets. The NNSA/ASC Tri-lab team will demonstrate three innovative visualization applications using a commodity cluster platform, advanced parallel I/O techniques, and leading-edge storage subsystems provided by the SC05 StorCloud Initiative.

Our visualization infrastructure employs an InfiniBand (IB) fabric for message passing and I/O, and a 10 Gigabit Ethernet network as the common I/O infrastructure suitable for data sharing. Our twelve-node visualization cluster and its four I/O nodes are interconnected with a Flextronic IB switch and Host Channel Adapters (HCA) that implement Mellanox's latest DDR technology delivering 20 Gbps link speed. The four I/O nodes in turn access native IB storage subsystems (contributed by DDN, STK, and Voltaire) over the same IB fabric extended to the StorCloud, both via a pair of Voltaire switches. Additionally, we partnered with Chelsio and Fujitsu to deploy a10 Gigabit Ethernet-based iSCSI storage subsystem from Intransa. Parallel I/O to all storage is achieved through the Lustre filesystem by CFS.

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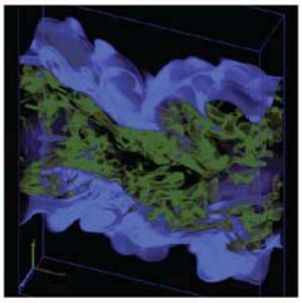
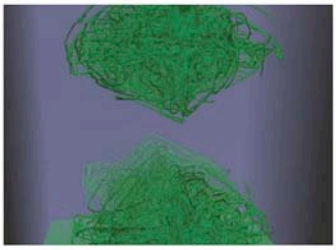
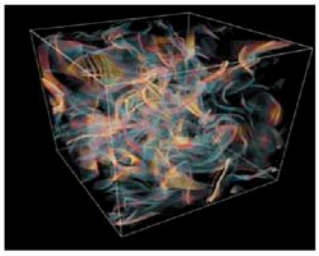

From left to right: 3D Direct Numerical Simulation of a Turbulent Flame, Crack Propagation in CU Atoms. and Turbulent Flow Vorticity Distribution

Simultaneous Visualization of Simulated Combustion Data

Jackie Chen, Evatt Hawkes (SNL), Kwan-Liu Ma (UC Davis)

High-fidelity Direct Numerical Simulation of turbulent, non-premixed flame presents tremendous challenges to subsequent data visualization and analysis. To understand the dynamic mechanisms of extinction and re-ignition in turbulent flames, interactive visualization is helpful. In this demonstration, we present visualization strategies using a suite of advanced visualization techniques to solve the fundamental problem of visualizing two or more variables simultaneously for improved understanding and validation.

ViSUS: Visualization Streams for Ultimate Scalability

Holger Jones and Eric Brugger (LLNL)

ViSUS is a distributed framework for real-time streaming and visualization of large datasets generated by scientific simulations. ViSUS uses progressive rendering algorithms and parallel/hierarchical data streaming techniques to reduce the latency between the simulation and its attached visualization and analysis tools. This framework is to match the available I/O and network resources, as well as the desired visual fidelity.

Visualization of Simulation of Compressible Turbulent Flow in 3D

Parks Fields, Dave Modl (LANL), Paul R. Woodward (UMN)

The movie demonstrates the development of a multi-fluid mixing layer under the action of a shear-instability, with air blowing over a region of sulfur hexafluoride in one direction and another in the opposite direction. This shear has a sine function velocity, and a mixture profile with an initial thickness of 16.3 cells. The vertical velocity perturbations in the fundamental mode and its 11th harmonic cause the Kelvin-Helmholtz instability to bring about the mixing, allowing the turbulence model to predict the energy transfer from the small turbulence on the near side to the larger flow on the far side.

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NNSA National Nuclear Security Administration

for more information

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